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PCB TESTING IN THE COMMUNITY NEAR

CANADIAN GENERAL ELECTRIC - DAVENPORT/LANSDOWNE

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INTRODUCTION

PCB's are a class of chlorinated aromatic hydrocarbon compounds that have become widely dispersed, if not ubiquitous, throughout the environment; this is especially evident in areas where these compounds have been manufactured or used, and in aquatic systems (13). PCB's are very resistant to degradation and tend to persist in the environment, where they are absorbed in the fat of living organisms and bioconcentrated up through the food chain, adversely affecting the global ecology and posing a potential health threat to humans.

Since learning about the PCB contamination at the Canadian General Electric plant - Davenport/Lansdowne, there has been much concern expressed regarding possible exposure of the surrounding community to PCB's, and related health effects. This report reviews the available information on the extent of PCB exposure and its health effects in the general population, in the C.G.E. workers and in the surrounding community; and discusses testing for the extent of exposure in the community.

GENERAL POPULATION

A. Contamination of the Environment

1. Soil

Surface soils around urban areas and downwind from them have PCB levels in the order of a few ppm. to 100 ppm., whereas the corresponding PCB levels in rural areas may be less than a few ppb. (9). The data on PCB levels of many urban and rural soils in North America are not available. Surveillance of PCB distribution in soils (and water systems) is generally limited to recognized contamination, spills, or accidents causing food chain impacts. In Canada, attempts have been made to estimate PCB concentrations in soil indirectly, by studying woodcocks who have been feeding on soil inhabitants such as earthworms; these data have not yet been verified or confirmed (9).

A study of 88 agricultural soil samples in Japan revealed the following: 40% of the samples contained less than 10 ppb. PCB's, 24% contained 10-100 ppb., 21% contained 0.11-1.0 ppm., 7% contained 1.1-10 ppm., 3% contained 10.1-100 ppm., and 5% contained over 100 ppm. (5). The main source of this PCB contamination came from industries utilizing PCB's.

There have been several American studies of pesticide residues in soil. An urban soils monitoring program was

conducted in 5 American cities in the early 1970's, with a minimum of 50 samples per city. 0% - 3.9% of the samples had detectable PCB's, with values ranging from 0.09 to 0.74 ppm. in Baltimore, Maryland, and as high as 11.9 ppm. in Alabama (2). In a survey of rice-growing soils in 5 states, only 4.2% of 99 samples had detectable PCB's, ranging from 0.05 ppm. to 1.13 ppm. (3).

In Ontario, few soil studies have been carried out by the Ministry of the Environment in the absence of a specific concern. However, based on the limited data available, soil in urban areas where there is no known source of PCB's will contain levels below the detection limit (0.01 ppm.), and only occasionally as high as 0.1 ppm. Soil in urban areas where there are known sources of PCB's will contain .01-.5 ppm. (7).

2. Air (13)

The particulate matter of industrial air environments where PCB's are used may carry as high as 50 ppm. PCB's; this disperses into the outer environment, depositing on surfaces, i.e., "fallout" on land and surface water bodies. Concentrations of 1-50 ng./m3 have been detected in the ambient air. As well, concentrations up to 180 ppm. have been detected in house dust.

3. Water (13)

Levels in water range from less than 0.5 ng/ml. in nonpolluted fresh water to 500 ng/ml. in highly polluted rivers.

4. Other (13)

In the late 1970's, trace amounts of PCB's were still detectable in paper, paperboards, food packaging material and even in toilet paper.

B. Sources of Human Exposure

Potential sources of human exposure include: ambient air, water, food, soil, industrial sources (remaining contaminated material, electrical equipment in use), and new contaminations such as spills or discharges of waste PCB's. In general, the major sources of human exposure are: occupational (1), and consumption of game fish from contaminated waters, e.g., Great Lakes Basin (2).

C. Surveys of General Population

Everyone has PCB residues in their body tissues, the amount depending on the extent of local pollution and the amount of fat tissue; the level tends to rise with age, and is usually higher in males than in females (13).

1. Blood

Blood PCB levels are not routinely monitored in the general population. All data available pertain to adults only (4). Mean serum levels ranging from 2.1 to 24.4 ppb. have been reported in the general population. The mean serum PCB level in Canada is now thought to be 3-5 ppb. (4), the level having decreased since the ban of PCB production; levels as high as 15 ppb. are still considered the "ambient norm" (12). (Medical testing is indicated for individuals with levels over 50 ppb.) (8).

2. Adipose Tissue (13)

In Canada, a nation-wide monitoring program for chlorinated hydrocarbons in adipose tissue has been studying PCB residues since 1972, using samples obtained at the autopsies of accident victims. The average level of PCB's appears to have remained constant at 1 ug./g. wet wt.; Ontario residents had the highest average PCB residue level for all of Canada (1.791 ug./g. wet wt.).

3. Breast Milk (13)

Low levels of PCB's were first detected in human milk during the mid-1960's. In 1972, samples from about 3.5% of the total female population surveyed in Japan contained levels as high as 0.2 ppm. with an average as high as 0.047 ppm. in fishery areas, and as low as 0.026 ppm. in agricultural areas.

In the 1970's, a Canadian advisory committee recommended 50 ppb. as the upper guideline for breast milk, based on the very limited data available (mainly from primate studies) (4). If the level exceeded this, women were advised to consult with their physicians regarding the suitability of breastfeeding. Two recent national breast milk surveys showed average levels of 6 ppb. and 12 ppb.; trends cannot be commented on as the level of detection changed in the interim. Only 1-2% of all samples were above the 50 ppb. guideline.

Four surveys of PCB concentration in the breast milk of volunteer mothers were conducted in Ontario between 1969

and 1979 (10). These indicated that the levels had declined substantially. The mean PCB level in human milk fat declined from 1.0 ppm. in 1969 to 0.65 ppm. in 1979, although levels as high as 2.6 ppm. were still evident; the 1979 mean of 0.65 ppm. in milk fat translates to 22 ppb. PCB's in whole milk. This decline may in part be due to the increased surveillance of food offered for sale, such as meat and dairy products, as well as warnings for women to decrease their consumption of fish from the Great Lakes.

D. Health Effects (See Appendix A)

Health & Welfare Canada is presently conducting a long-term, low-level feeding study of Rhesus monkeys to study the effects of PCB's on behaviour, the immune system, reproduction and offspring (4).

CLINICAL & BIOCHEMICAL SURVEY OF C.G.E. WORKERS EXPOSED TO PCB's

During the spring and summer of 1984, C.G.E. offered a medical assessment to all present and past employees of its plant at Davenport/Lansdowne. This consisted of a medical history, physical examination, serum lipid and liver function tests, as well as a fasting serum PCB level. The results were recently presented in a report written by the plant physician, Dr. I.R. Greenwood (14). The methodology, analysis and results provided are summarized and critiqued below.

The stated purpose of the survey was to study workers exposed to PCB's in their daily work (usually through direct dermal contact while handling transformer oils), and to compare these workers with others at the plant whose exposure to PCB's was indirect at most. The specific characteristics to be compared are not delineated, and levels of statistical and/or clinical significance are not defined beforehand.

113 workers volunteered to participate in the survey in response to memos posted in the plant and notices in the company newspaper to retired and disabled workers. 108 of these individuals actually consented to be examined. The report does not give the total number of individuals who worked at the plant during the period when PCB's were used, i.e., 1942-77; hence the response rate is not known. The use of volunteers introduces selection bias, as the representativeness of the sample with respect to age, type and duration of work, etc., is not addressed. Any individual who died after exposure and prior to this survey would likely be missed using the above approach.

Using the work codes, C.G.E. management identified a total of 24 employees who had had direct contact with PCB's. The fact that 13 more workers with such exposure were identified by the workers themselves, and that their history was verified in the work records, suggests that C.G.E. probably used conservative criteria for exposure and may therefore have underestimated the exposed population. This would dilute any effect seen.

Although all individuals with direct PCB exposure were telephoned by C.G.E., only 26 (or 70%) of the 37 identified agreed to participate. One individual had died, although no details were provided. The number of follow-up attempts made, and the reasons for refusal to participate are not given.

The survey included a total of 26 men with direct PCB exposure, and 82 workers with nominal exposure (19 men, 63 women). The comparability of these two groups is not properly addressed, i.e., statistical comparison with respect to age, type of work, duration of exposure, etc. The small sample size, particularly of the exposed population, may decrease the power of the study, potentially causing significant differences to be missed.

Blood specimens were obtained by an independent technician from a private laboratory. Serum PCB levels were determined by gas chromatography at the Ontario Ministry of Labour Occupational Health Laboratory. All clinical assessments were carried out by the C.G.E. plant physician with full knowledge of the individual's biochemical test results, thereby introducing potential bias into the assessment.

Results

The report indicates that no chloracne was detected and there were no reported cases of chloracne. However, this absence of findings would be expected 7-8 years after discontinuing exposure, and the report describes at least one individual with a history suggestive of chloracne.

There were no abnormalities of the liver or central nervous system on examination, and no cases of liver or rectal cancer reported. (Recall that deaths occurring prior to this survey were generally not included in the report; hence cases may have been missed). In the nominally exposed group, one individual had a history of cholecystectomy, another had a history suggestive of gall bladder disease, and another was on medication for hypertriglyceridemia.

Serum PCB levels were less than 20 ng./ml. in all individuals tested. The report intimates that any PCB intake in the tissues had therefore been cleared. However, it is well known that PCB's are rapidly cleared from the blood after exposure is discontinued, whereas they tend to persist in adipose tissues - these tissues

were not tested in this survey. As well, the report does not provide the range of the serum PCB results or their mean levels, to enable comparison of exposed and nominally exposed groups.

Serum triglycerides, cholesterol, and liver function tests (SGOT, alkaline phosphatase, LDH) were averaged for each of the following groups: exposed men, nominally exposed men, and nominally exposed women; these means were listed in a table containing the normal range of values for each test in an individual, as cited by a laboratory. The report states on page 1: "The biochemical tests for the group showed that the levels were within the normal ranges, except for triglycerides in the nominally exposed men". This is a meaningless statement. It is inappropriate to compare a sample mean with the norm for individuals. The mean of the exposed group should be statistically compared with that of the comparable nominally exposed group.

A false impression can result from looking at the mean only. The report does not contain the range of the biochemical test results or the standard deviations from the mean. Such exclusion of detail is not scientifically acceptable and decreases the credibility of the report.

In particular, the means for cholesterol and alkaline phosphatase appear to be in the upper range of the norm and may be of concern. The mean cholesterol in exposed men was 6.16 mmol./l., with a mean of 5.46 in nominally exposed men (normal values ranging from 3.5 to 6.85). The mean alkaline phosphatase in exposed men was 89 mU/ml. (normal values ranging from 35 to 110); apparently at least 13 workers had results above 110 units (15). One of these individuals is on propylthiouracil, a medication known to affect liver function tests. It is important to remember that a few individuals with such factors in this small sample may easily confound the results.

The report does not indicate whether workers with abnormal results were referred to their private physician for examination. Such action is certainly indicated and the results of any such examinations should be made available to the Medical Officer of Health.

IN SUMMARY

- the specific characteristics to be compared were not delineated in the stated purpose of the study;
- levels of statistical and clinical significance were not defined beforehand;
- the total number of exposed individuals is not given, therefore the response rate cannot be calculated;

- selection bias is evident, as this was a volunteer sample;
- the study underestimated the exposed population;
- inadequate comparison of the control and study populations;
- small sample size, with potential for confounding of results;
- potential observer bias, as physical examinations were not done blindly;
- low serum PCB levels do not necessarily indicate that any PCB intake has been cleared from the tissues;
- failure to conduct appropriate statistical tests on the biochemical test results;
- failure to provide data on individuals;
- were individuals with abnormal results referred to their private physician for investigation?

Due to problems with both the methodology and the analysis, it is not possible to conclude that "The biochemical tests for the group showed that the levels were within the normal ranges, except for triglycerides in the nominally exposed men". In order to draw such a conclusion it would be necessary to rectify the problems noted above.

COMMUNITY NEAR C.G.E. - DAVENPORT/LANSDOWNE

A. Contamination of the Environment

As described in the January, 1984 report to the Local Board of Health on health aspects of PCB's (see Executive Summary, Appendix A), any direct exposure to PCB's in the community would likely occur via exposure to contaminated surface soil. Such soil may be swept off the C.G.E. site to the immediate neighbourhood through re-entrainment (soil adheres to a vehicle's tires and is dispersed as the vehicle travels in the neighbourhood, and/or soil is moved by running surface water, e.g., after a storm), or through wind dispersal of surface dust (7).

Human exposure could then occur via ingestion of the contaminated soil (mainly by children), and to a lesser degree, via skin contact and inhalation. The worst average PCB level in the soil on-site was 510 ppm. Exposure to such soil by neighbourhood children on a continuous basis would be a major concern.

Based on these concerns, the Ontario Ministry of the Environment conducted an elaborate community surface soil sampling study in May 1984, the detailed results of which are not yet available. We have been led to believe that the highest reported PCB level on residential property is 0.51 ppm., which is in the range of values expected in an urban area where there is a known source of PCB's (7); the 0.51 ppm. level is approximately 1/1000 of the highest average level on the C.G.E. site, and 1/100 of the Ministry of Environment soil standard. Indications are that the prime source of exposure is the C.G.E. site.

B. Health Effects

In general, the level of PCB's in the community appears to be low; this amount of environmental exposure is probably insignificant as compared to those occupationally exposed (12).

If we assume that the highest surface soil PCB level in the residential area is 0.5 ppm., the daily exposure of a neighbourhood child can then be estimated. For a 10 kg. child, assuming direct dermal contact with 1 gram of such soil per day, with a 1% absorption rate, the daily intake would be .0005 ug/kg. body weight (16). Assuming this child ingests 1 gram of the soil (and possibly dust in the air) per day, with a 10% absorption rate, the daily intake of PCB's would be .005 ug/kg. body weight, or 1/200 of the 1 ug/kg. guideline (16).

Therefore, based on the available information about exposure, and our knowledge regarding PCB-related health effects, there are unlikely to be any significant health effects resulting from environmental exposure to PCB's in this community.

Contamination of this magnitude will generally not result in the accumulation of detectable levels of PCB's in the edible portions of crops such as carrots or radishes grown in neighbourhood vegetable gardens. However, PCB's will accumulate up to 0.08 ppm. in carrot root peel grown in 0.5 ppm. Aroclor 1254 (9).

C. Testing for Extent of Exposure

1. Rationale

It is the opinion of a number of experts who were consulted that, based on the available information and knowledge, there is little if any scientific rationale for further testing at this time (1, 6, 8, 11, 12). The level of environmental exposure is low and comparable to

that in other urban industrial areas with known sources of PCB's. Such levels are not known to be associated with health effects. Symptoms of throat and eye irritation reported in the adjacent Junction Triangle area are not compatible with our present knowledge of low-dose PCB-related health effects. Also, it is well known that PCB's are ubiquitous in our environment and can be found in everyone's tissues; hence it will be difficult to interpret the results of community testing unless they are significantly elevated as compared with controls. Finally, there are no data available on "usual" PCB levels in children, again making data interpretation difficult.

However, there is a large amount of anxiety and fear in the community regarding PCB's, one of the few specific chemicals identified in the Junction Triangle area to date. This in itself is a valid reason for conducting some testing of individuals in the community for PCB's (12). Such testing should be conducted in a scientific manner so as to help ensure that meaningful results will be obtained.

2. Methods Available

There are several ways to look for evidence of PCB exposure in an individual.

a) Plasma PCB level - A minimum of 10-20 mls. of blood is required (1). Some authorities recommend that blood be taken after a 12-14 hour fast so as to mobilize fat. The kinetics of PCB's are poorly understood, and it is not really known whether fasting gives a more accurate level (12).

   The plasma level reflects current exposure.

b) Adipose tissue PCB level - A minimum of 1-2 grams of tissue must be obtained by biopsy, with its attendant discomfort and bleeding (1). The adipose tissue PCB level reflects both current and past exposure.

c) Breast milk - A minimum of 50 mls. is required (1).

   All of the above are equally valid tests of the PCB level in fat. The analysis would cost $75-$160 (1)(11)(12) per sample at a private laboratory, although it is likely that limited testing could be arranged at a substantially lower cost through the University of Guelph (1) or Ministry of Labour (8).

d) Carbon -13 dioxide breath test - This is an experimental non-invasive method of monitoring liver enzyme activity.

e) Liver function tests and serum lipids.

f) Chromosomal analysis.

The latter three tests are very indirect measures of exposure to a variety of toxic substances including PCB's. If abnormalities were found, it would still be necessary to do a more direct test to assess if indeed there had been exposure to PCB's (4).

3. Recommended Study

Due to community concern about ongoing exposure to PCB's, and for practical reasons, it is recommended that (non-fasting) plasma levels of PCB's be measured rather than adipose tissue levels. This should be done on a sample of 20 children residing closest to the C.G.E. plant (at least within 500 m. of the plant) and a sample of 20 age and sex matched controls. It is important to control for a history of other exposures to PCB's (e.g., pesticide use, fish intake, etc.) and for recent weight loss. Those residing closest to C.G.E. are chosen so as to maximize the probability of finding a statistically significant difference between the two groups (using a Students' t-test, p .05) (12). A result of 50 ppb. or greater would be clinically significant.

New mothers residing in the area may have their breast milk checked for PCB's if they wish. These results will be compared to levels found in the general population, using criteria for clinical and statistical significance as described above.

RECOMMENDATIONS

1. That the Board of Health authorize the Medical Officer of Health to carry out a study of PCB levels in the community surrounding the C.G.E. - Davenport/Lansdowne plant as described, and make the results available to the public without delay.

2. That the Board of Health strongly urge the Ministry of the Environment to make the community soil sampling report available to the public.

3. That the Board of Health request Canadian General Electric to further develop and revise their report on the medical assessment of C.G.E. workers, as detailed in this report.

APPENDIX A

EXECUTIVE SUMMARY OF HEALTH ASPECTS OF PCB's

REPORT TO LOCAL BOARD OF HEALTH, JANUARY 1984

PCB's are a family of synthetic chemical compounds which were manufactured and used on a mass scale from 1929 until the early 1970's. Their primary application was in the electrical industry, serving as liquid insulating material for transformers and capacitors.

These compounds are nonflammable, possess a high electric resistivity, and a high degree of chemical and biological stability: they are relatively insoluble in water and highly soluble in organic compounds. They are therefore very resistant to degradation and tend to persist in the environment, where they are absorbed in the fat of living organisms and bioconcentrated up through the food chain, adversely affecting the global ecology and posing a potential health threat to humans.

The major sources of human exposure are (1) occupational, and (2) consumption of game fish from contaminated water, e.g., Great Lakes Basin.

The toxic effects of PCB's are complex and not well understood. Numerous toxicological studies have been performed on various animal species. Rhesus monkeys are particularly sensitive to PCB's, showing effects similar to those of humans with a similar order of exposure. In general, acute toxicity is low and effects are cumulative with prolonged administration. Long-term toxic effects including liver tumours and reproductive effects have been demonstrated in laboratory animals exposed to relatively high doses of PCB's. No long-term, low-level feeding study has been reported.

Serious outbreaks of PCB poisoning have been reported in man and domestic animals from ingestion of food accidentally contaminated with PCB's.

The early literature reports cases of chloracne, with liver involvement, among men engaged in the manufacturing of PCB's. More recent studies of workers with occupational exposure to PCB's have demonstrated the presence of quite high serum PCB levels in association with biochemical abnormalities in plasma lipids and liver enzymes, but no evidence of clinically detectable illness. There is no clear evidence of carcinogenic effects in humans. Based on tests, including negative Ames test results, PCB's do not cause genetic damage in cells.

A retrospective cohort mortality study of 2,567 workers conducted by NIOSH in 1975, found no significant increase in mortality from all causes, or all malignancies. A greater than expected number of deaths was found for liver cancer; although this excess was not statistically significant, it warrants further investigation.

To date, human exposure to PCB's has not been shown to be directly associated with any long-term adverse health outcome except the occurrence of chloracne in the early years of use. However, given the animal study results, the limitations of epidemiological studies and the biochemical evidence of alterations in liver enzymes, prolonged follow-up of an exposed cohort over time is required to further study the possibility of liver damage. In essence, very little is known about the long-term health effects of prolonged low-dose PCB exposure.

Guidelines have been set for human PCB exposure by extrapolating from animal studies and dividing by a safety factor.

(1) WATER: 3 ppb is the maximum acceptable concentration under the Drinking Water Guidelines - An aquatic life objective of 1 ppt. has been set by the International Joint Commission.

(2) SOIL: 50 ppm. is the regulatory cut-off.

(3) FOOD: PCB intake should be less than 1 ug./kg. body wt. per day.

Human exposure to PCB contamination from the Canadian General Electric plant could occur in the following ways:

AMBIENT AIR

PCB's have not been detected in the air on-site. Air exposure does not pose a health hazard.

WATER

The worst average PCB level in the water on-site was 7 ppb., with a maximum of 48 ppb. and a minimum of 0.01 ppb. As there is no well water consumed from the affected area, it is unlikely that any direct human exposure via consumption occurs to this water.

Sewer water has been contaminated, with a maximum PCB level of 35.9 ppb., and a minimum of 0.73 ppb., but no one consumes water straight from the sewer. By the time this water reaches the lake, its PCB content has been greatly diluted.

This effluent then goes on to mix with lake water, further diluting the PCB's. PCB levels found in Toronto's drinking water range from 2 to 30 ppt., or about 1/1000th the MAC value of 3 ppb.

Direct exposure to PCB's from contaminated drinking water is not of major concern in this instance.

FISH

A real concern with lake water contamination is the potential contamination of the food chain, especially of sport fish. Consumption of contaminated fish represents a health hazard to the general community.

SOIL

Contaminated soil may be swept off-site to the immediate neighbourhood; exposure could then occur via ingestion of the contaminated soil (mainly by children), and to a lesser degree, via skin contact and inhalation.

The worst average PCB level in the soil on-site was 510 ppm.

The highest PCB levels were found in soil several feet underground with values as high as 2000 ppm. This would present a health hazard if the site is excavated, allowing this contaminated soil to be blown around, potentially exposing the workers and the immediate neighbourhood.

Surface soil contamination is of more immediate conern. The highest surface soil PCB levels were found in the ditch on the north side of the C.P. train tracks, with levels ranging from a high of 1212 ppm. to a low of 114 ppm. Exposure to such soil by neighbourhood children on a continuous basis is a major concern. For a 10 kg. child, assuming direct dermal contact with 1 gram of soil per day, containing 510 ppm PCB's with a 1% absorption rate, the daily intake would be 0.5 ug/kg. body weight. Assuming this child ingests 1 gram of the soil (and possibly dust in the air) per day, with a 10% absorption rate, the daily intake of PCB's would be 5 ug/kg. body weight, exceeding the 1 ug/kg. guideline.

OTHER

A layer of highly contaminated oil, containing 40,000 ppm. PCB's, is sitting on the water table on-site.

Although PCB's are not very soluble in water, presumably this deposit of concentrated PCB's is likely to be a continuing source of low-level ground water contamination. This oil represents a major hazard to workers involved in the clean-up process.

RECOMMENDATIONS

1. That the Local Board of Health strongly urge the Ministry of the Environment to make available information regarding PCB leakage or spills to the public without delay.

2. That the Local Board of Health require Canadian General Electric to remove the contaminated surface soil from the ditch early in Phase 1 of their clean-up program, or as an acceptable interim measure, that the area be sealed with a heavy gauge plastic membrane.

3. That the Local Board of Health require Canadian General Electric to ensure that any excavation of contaminated soil be carried out in a manner so as to prevent its dispersion.

4. That the Local Board of Health recommend to the Minister of Health, Ontario, the Minister of Health & Welfare, Canada, and their colleagues in the Ministries of Labour and Environment as appropriate, that further research be undertaken to determine the human health effects of low-level and chronic exposure to PCB's, to include long-term, low-level feeding studies in animals.

5. That the Local Board of Health request that the Federal and Provincial Ministries of Labour and Environment review the adequacy of the current environmental criteria and guidelines set for human PCB exposure.

6. That the Local Board of Health request the Ministry of Labour and Canadian General Electric to carry out a retrospective study of exposed workers and establish a registry to follow these individuals re specific health outcomes, liver disease in particular.

7. That the Local Board of Health request that the Ministry of Labour ensure ongoing worker education on the persistence of PCB hazards and their identification in the workplace.

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CLINICAL AND BIOCHEMICAL SURVEY
OF CGE DAVENPORT WORKERS
EXPOSED TO PCB'S

Conducted by
I.R. Greenwood, M.D.
Plant Medical Consultant

Presented to
THE ONTARIO MINISTRY OF LABOUR
AND THE CITY OF TORONTO, PUBLIC HEALTH DEPARTMENT

on
December 4th, 1984
Davenport Works
940 Lansdowne Avenue
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CLINICAL AND BIOCHEMICAL SURVEY OF C.G.E. DAVENPORT WORKERS EXPOSED TO PCB's

Davenport, December 1984
by
I.R. Greenwood. M.D.
Plant Medical Consultant

EXECUTIVE SUMMARY

At the request of the Local Board of Health, City of Toronto, a survey was conducted of C.G.E. workers possibly exposed to PCB's in the Davenport facility in Toronto. One hundred and thirteen workers volunteered for the study, of which 108 consented to be examined. The study consisted of a medical history questionnaire, physical examination, liver function, and blood PCB level.

The study consisted of 26 men who had direct contact with PCB, and 19 men and 63 women who were classed as having nominal exposure because they worked in the Davenport complex.

No kidney, liver or neurological illnesses were found in the PCB exposed men or the nominally exposed men and women. No case of true chloracne was detected, and no liver cancer was found.

The biochemical tests for the group showed that the levels were within the normal ranges, except for triglycerides in the nominally exposed men.

In all cases, the PCB in blood was less than 20 ng/ml.

INTRODUCTION

Polychlorinated biphenyls (PCB's) comprise a group of synthetic chlorinated hydrocarbons that were widely used as insulating oils in the electrical industry because of their stability and resistance to oxidation.

At CGE Davenport, in Building 18, transformer oils consisting of 30 - 60% PCB, were used from 1942 to 1977 in some transformers. Concern about possible toxicity and environmental persistence caused CGE to voluntarily discontinue PCB use in 1977.

The purpose of this survey was to study workers exposed to PCB's in the course of their daily work, usually by skin contact in handling the transformer oils, and to compare these workers with other workers in the Davenport complex but whose exposure to the chemicals was indirect at most. The survey consisted of a medical history, physical examination, and biochemical testing including serum PCB levels, all performed in the spring and summer of 1984.

SUBJECTS

One hundred and thirteen (113) workers participated in the study, and one hundred and eight (108) consented to be examined. Volunteers were elicited by means of memos displayed on all plant bulletin boards; early volunteers were encouraged to enlist the support of others. Notices were placed in the Company newspaper to notify retired and disabled workers. No comprehensive telephone campaign was mounted but all workers, retired workers, and those receiving L.T.D. (Long Term Disability) benefits were telephoned if they were mentioned by fellow workers as having been potentially exposed to PCB's.

A list was developed by management of 24 workers whose work codes indicated that they had direct contact with PCB's, and these men were approached systematically by phone. Thirteen (13) of the twenty-four (24) participated in the study; one was deceased; and the others did not wish to participate despite repeated attempts by the medical staff. During the preliminary registration procedure, several workers reported direct exposure to PCB's, and their work records were reviewed. As a result of this review, another thirteen (13) men were included in the exposed group. Nineteen (19) men, and sixty-three (63) women were included in the 'nominally exposed' groups. The characteristics of the groups are listed in Table 1.

METHODS

All the participants were interviewed using a standard form (see Figure 1), which gave them the opportunity to estimate their length of exposure to PCB's, and to detail the nature of their contact with it. Medical histories were obtained later by the physician at the time of the physical examination.

After a 12 to 14 hour fast, blood specimens were obtained by an independent technician from Gamma North Peel Laboratories using an acceptable technique. Serum PCB levels were determined by gas chromatography at the Ontario Ministry of Labour Occupational Health Laboratory under the supervision of Dr. V. Gaind. A battery of clinical biochemical tests were performed on the samples by the Gamma North Peel Laboratories.

After the results were obtained, the participants returned individually to the plant physician to have the results explained in detail. At that time medical histories were obtained and a physical examination performed, paying particular attention to the span and texture of the liver, the skin, and the neorological system.

RESULTS

There were no reported renal, hepatic, or neurological illnesses among the PCB exposed men. There were no reported cases of chloracne. One worker reported a skin lesion on his feet that consisted of crops of blisters, clearing after contact with PCB's ceased. One worker reported that his acne was worse with exposure. Physical examinations of the other exposed workers revealed no abnormalities of the liver, skin, or neurological systems.

RESULTS (Cont'd)

Among nominally exposed men one reported a cholecystectomy and another was taking Atromid S therapy for hypertriglyceridemia. No abnormalities were seen on physical examination. One of the nominally exposed women had a history suggestive of gallstones, as well as a tender liver edge; another woman had a tender liver edge as well as elevated hepatic enzyme levels. There were no other liver, skin, or nervous disorders in this group on physical examination.

Non-PCB related illnesses reported by the exposed men included one case each of leg varicosities, peripheral edema, hypertension, angina pectoris, and hyperthyroidism. One of the nominally exposed men was hypertensive and another had shingles. Among nominally exposed women there was one case each reported of insulin dependant diabetes, hypertension, duodenal ulcer, hypothyroidism, and an interesting case of probably transient bone marrow suppression after taking the analgestic Zomax. These findings are normal occurrences for this age group.

There were no liver cancers reported. One of the exposed men, a heavy smoker, had a carcinoma of the lung diagnosed in 1982, and one of the nominally exposed men had a basal cell carcinoma, a common cancer of the skin, which was treated in 1980.

All of the serum PCB levels were reported as being less than 20 nanograms per millilitre (ng/ml) of serum. One specimen was reported as 43, but was found to be less than 20 on repetition.

The biochemical results were averaged for the three groups, and the results appear in Table 2. It can be seen from the table that the results were in general similar for the groups and within the normal ranges except for triglycerides in the nominally exposed men.

DISCUSSION

In this study a group of employees in a transformer assembly plant were medically examined and had their blood tested for PCB 7 years after the voluntary cessation of PCB use in the manufacturing process. The examination was focussed on the skin, liver and neurological systems since the literature has reported these organs as being sensitive to chlorinated hydrocarbons.

No dermatological findings were present in our group. No chloracne was detected. Fischbein et al (2) reported that about 50% of an exposed group of workers had rashes; Smith et al (3) did not find any chloracne in a group of capacitor manufacturing plant workers but did find a significant association of skin rash with high blood levels of PCB's. The literature suggests that skin rashes can occur with PCB exposure but that individual factors are probably also important. Studies of this area are complicated by the fact that the prevalence of skin disease is high: about 1/3 of all North Americans of working age have significant skin disease.

DISCUSSION (Cont'd)

The biochemical tests of nominally exposed and exposed workers, when averaged and compared did not show the patterns as reported in the literature, and in fact all the levels were within the normal ranges except for triglycerides in the nominally exposed males. Serum triglycerides and SGOT are most commonly elevated with PCB exposure; in our exposed men they averaged slightly lower than in the nominally exposed. Conversly, alkaline phosphatase and LDH are not usually affected; in our group they were higher mainly because of the abnormalities detected in 1 subject. No liver disease was revealed by history or physical examination. No evidence of long term or chronic hapatic disease was found in the group. One man had markedly elevated alkaline phosphatase and LDH levels but this may be accounted for by the fact that he was taking a medication, proplythioracil, that has been known to be occasionally hepatoxic. It is well known that drugs and alcohol may affect liver biochemistry.

The PCB level in blood was in all cases less than 20 ng/ml. The literature has reported levels between 24-1300 ng/ml for occupationally exposed workers (Chase (1), Smith (3), and Ouw (4)). Our results suggest that if there was any intake of PCB in the tissue it was cleared after the exposure ceased.

RECOMMENDATIONS

1. To publish the findings of this survey in the Company's newspaper.

2. To continue to offer to employees routine medical examinations for those who have concerns about the past PCB exposure on their health.

ACKNOWLEDGEMENTS

The author wishes to thank A. Doyle R.N. and E. Pacey R.N. for their assistance in the accumulation of the data. As well he wishes to thank A. Doherty, T. Smyth and M. Cleveland for their help in the production of the report.

TABLE 1

Characteristics of the Study Population

GROUPS	NO	AVERAGE AGE (years)	AVERAGE LENGTH OF EXPOSURE (years)
Nominally exposed females	63	50.1	13.3
Nominally exposed males	19	50.7	13.3
Exposed males	26	55.4	17.2
	108		

TABLE 2

Average Biochemical Resuts

TEST	NORMAL VALUES (range)	EXPOSED Men	NOMINALLY Exposed Men	NOMINALLY Exposed Women
Triglycerides	< 2.37	1.71	2.44	1.45
Cholesterol	3.5 - 6.85	6.16	5.46	5.62
SGOT	10 - 40	17	18	15
Alkaline Phosphatase	35 - 110	89	77	71
LDH	110 - 240	151	137	153
Liver span	10 - 14	12	11	12

REFERENCES

1. Chase, K.H. et al Clinical and Metabolic Abnormalities Associated with Occupational Exposure to Polychlorinated Biphenlys (PCB's), J. Occ. Med. 24:109 1982

2. Fischbein, et al. Clinical Findings Among PCB Exposed Capacitor Manufacturing Workers. Ann. N.Y.A.S. 320:203 1979

3. Smith, A.B. et al Cross Sectional Medical Survey of a Group of Workers Occupationally Exposed to PCB's. N.I.O.S.H. 1981

4. Ouw H.K. et al. Use and Health Effects of Arochler 1242, a Polychlorinated Biphenyl, in an Electrical Industry. Arch. Environ. Health July 1976, 189.

P.C.B. WORKERS ASSESSMENT FORM
C.G.E.

10-5-84

NAME: _____ EMPLOYEE # _____ MALE ___ FEMALE ___

PLANT LOCATION _____ EMPLOYMENT STATUS - 1 2 3 4 DATE OF BIRTH _____ Year Month Day

DATE OF EXPOSURE FROM _____ TO _____

NATURE OF EXPOSURE CONTACT YES ___ NO ___ OTHER _____

NATURE OF WORK PERFORMED (at time of exposure) _____

	DATE OF EXAMINATION									
1.	GENERAL HEALTH HISTORY	NORMAL	ABN	VALUE COMMENT	NORMAL	ABN	VALUE COMMENT	NORMAL	ABN	VALUE COMMENT
	FATIGUABILITY APPETITE SKIN PROBLEMS									
II	PHYSICAL EXAMINATION									
	ABD - Liver; size, edge, consistency tenderness masses, other organs									
	SKIN- Acne form lesions - Pigmentation									
	CNS - Reflexes, tremour - Gait, motor, sensory									
III	BIOLOGICAL MONITORING									
	SERUM PCB LEVEL CCR CHOLESTEROL, TRIELYCERIDES									

EMPLOYMENT STATUS - 1 Still employed in Davenport 2 No longer employed by CGE
3 Retired 4 New

Signed _____ MD

REMARKS _____

Canadian General Electric

November 27, 1984

1420 DUPONT STREET, TORONTO, ONTARIO M6H 2B2

Dr. A.S. Macpherson
Medical Officer of Health
City Hall - 7th Floor
Toronto, Ontario
M5H 2N2

Dr. Peter P mear
Ontario Min try of Labour
400 Univers y Avenue
Toronto, Ontario
M7A 1T7

Dear Dr. Macpherson:

This is to confirm that a meeting will be held so that CGE's medical consultant can present the findings from the health study at Davenport workers potentially exposed to PCB's in the past.

PLACE:	Bldg. 15 Conference Room 940 Lansdowne Avenue	
TIME:	9.00 a.m.	
DATE:	December 4, 1984	
INVITEES:	Dr. A.S. Macpherson or alternate, Brian Gibson	City Public Health
	Dr. P. Pelmear or alternate, Thor Taranchuk, Gary DeLaur	Ministry of Labour
	Dr. J. Millman	CGE Consultant
	Dr. R. Greenwood	CGE Consultant
	Mr. T.W. Sutherland	CGE Vice President

Copies of the report will be made available.

Yours truly,

H.R. Hosein

H.R. Hosein, PhD
Manager-Safety, Industrial
Hygiene & Environment
Corporate Human Resources

:mac

b.c. R.T.E. Gillespie
R.T. Martin
I. Lamb
L.E. Gray
H.G. Giles
C.A. Demers

CONCENTRATIONS OF POLYCHLORINATED BIPHENYLS IN SOIL IN THE VICINITY OF CANADIAN GENERAL ELECTRIC Co. Ltd., 940 LANSDOWNE AVE., TORONTO

MAY, 1984

ARB-222-84-PHYTO

NOVEMBER, 1984

Ontario
Ministry of the Environment

Concentrations of Polychlorinated Biphenyls in Soil in the Vicinity of Canadian General Electric Co. Ltd., 940 Lansdowne Ave., Toronto, May, 1984

Air Resources Branch
Phytotoxicology Section

By: *D.L. McLaughlin*

Date: *November, 1984*

ARB No.: *ARB-222-84-Phyto*

Ministry of the Environment
Ministère de l'Environnement
Ontario

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Concentrations of Polychlorinated Biphenyls in Soil in the Vicinity of Canadian General Electric Co. Ltd., 940 Lansdowne Ave., Toronto, May, 1984

HISTORICAL INFORMATION

Canadian General Electric Co. Ltd. has operated the plant at 940 Lansdowne Ave. since 1901. The company has manufactured low and high power electric utility transformers since 1921. Polychlorinated biphenyls (PCBs) were used as a di-electric fluid in the transformers manufactured at CGE since the early 1940's. The PCBs were not manufactured on site, but were brought in by railway tank car. CGE discontinued the use of PCBs in 1977 when concerns regarding the environmental hazards of this chemical became evident.

An environmental consultant retained by CGE identified significant PCB soil contamination centered around two locations on company property -building No. 36 and the adjacent building No. 26. PCBs were transferred from the railway tank cars and stored prior to use in a closed manufacturing process at these two sites. As PCBs were not vented to atmosphere during transformer construction, the resultant contamination must have occurred from spills and leaks during the transfer and storage operations.

STUDY OBJECTIVE

It was hypothesized that because of the amount of PCB used by CGE, the length of time the chemical was in use (35 years) and the degree of soil contamination on CGE property, soil contamination in the surrounding residential properties could have occurred. PCB is a sticky, viscous fluid with an extremely low water solubility and is strongly adsorbed onto solids, such as soil particles. The primary mode of off-property contamination would be through re-entrainment which involves the migration of a contaminant from an area of high concentration to an area of low concentration through ground level physical and/or mechanical contact. Soil or road dust contaminated with PCBs can adhere to the tires of vehicles, and can be dispersed as the vehicle travels along the roads in the surrounding neighborhood. In this manner the areas adjacent to Lansdowne Ave., Davenport Rd. and Dupont St. would be expected to have the highest off-property PCB soil concentrations. Similarly, leaking railway tank cars and the traffic volume along the CNR and CPR rights-of-way would make the track road bed another potential source of re-entrained contamination. PCBs deposited along the main traffic arteries would slowly spread laterally via surface water movement and ground level winds.

In January 1984 the Toronto Board of Health requested that the Ontario Ministry of the Environment conduct a soil survey for PCB contamination in the residential area surrounding CGE. The request was passed to the Phytotoxicology Section of the Air Resources Branch and the soil survey was conducted on May 16, 17 and 18, 1984. Limited re-sampling was performed on August 24, 1984. The objectives of the study were to (1) determine if PCB soil contamination had occurred off CGE property; (2) define the degree and extent of any contamination; and (3) identify the source of the contamination.

SAMPLE SITE LOCATION

Forty sites were selected for soil sampling. Twelve of the sites were on residential properties, 10 were municipal/religous (schools, street boulevards, churches and parks), 8 were located on CGE property, 5 on the

CNR or CPR rights-of-way, 4 were commercial locations (not CGE or railway) and one site was on land owned by the provincial government. Five of the 40 sample sites were control locations. Three of the control sites were from residential/commercial properties in urban areas similar to the study area but ranging from approximately 2.2 km to 9.0 km distance from CGE. The remaining two control locations were rural sites outside of the City of Toronto. The 35 soil sample sites in the vicinity of CGE were within 700 m of building No. 36. The approximate location of these sample sites is illustrated in Figure 1. Building No. 36 is the small rectangular structure immediately W of site 26. A precise description of all 40 sites is available in Appendix 1.

Soil was sampled relative to the major traffic arteries and railway rights-of-way as areas most likely to become contaminated through re-entrainment. Wind direction would have little bearing on PCB dispersal as the wind at ground level in an urban area would not necessarily reflect the ambient direction. However a review of the meteorological data revealed winds from all directions are common with a slight tendency towards W and SW during the non-winter months.

Soil was sampled on CGE property for two reasons. First, to establish a concentration gradient to see how much of the PCBs known to have contaminated soil on company property has migrated into the surrounding community. Second, to determine if PCBs found in the soil off-property is the same as the PCBs in soil on CGE property thereby confirming CGE as the source.

SAMPLING PROCEDURE AND PRECAUTIONS

Previous Phytotoxicology PCB soil studies have revealed that PCBs normally are below detection limits (0.01 ppm) in urban soil in the absence of a contaminating source. Occasionally levels in the range of 0.01-0.1 ppm are detected without any apparent source being identified. For this reason a number and variety of control sites were included in the soil sampling program. Also, an elaborate sampling procedure was employed to prevent cross contamination as a result of PCBs adhering to the sampling equipment.

Briefly, the sampling procedure for PCBs is the same used for other toxic and/or tenacious organic compounds where high resolution (low ppm) analyses are required. Cross-sample contamination was controlled by using laboratory-clean sampling equipment at each site. The soil corer was washed with an alconox solution and rinsed with distilled water. The washing step was repeated until all visible soil residue was removed. This was followed by a rinse with 95% denatured alcohol to completely dry the equipment. To remove any residual trace organics which may have adhered to the chromed surface of the sampling corer it was then rinsed with 1,1,1-trichloroethane.

To further minimize any possibility of cross-site contamination all sites were assumed to be contaminated relative to their distance from CGE; accordingly within the survey area the sites farthest from CGE were sampled first, followed by progressively closer locations. The field personnel wore clean disposable plastic gloves at each site so that the soil was never touched by unprotected hands.

A 2 m diameter circular plot was established at each of the 40 sample locations. Actual sample collection from within each plot consisted of 15 to 20 soil plugs 2 cm in diameter and 5 cm in depth, yielding approximately 500 g of soil. The soil was placed in wide-mouth, amber-coloured glass jars which had been solvent-rinsed in preparation for organic samples. The sample jar lid was foil-lined and secured with tape when sample collection was completed. The filled sample jars were placed in a light-tight, insulated cooler until delivery to the laboratory.

ANALYTICAL PROCEDURE

The samples were delivered to the Organic Trace Contaminants Section of the Laboratory Services Branch at the Environment Ministry's main laboratory at Hwy. 401 and Islington Ave., Toronto.

The analyses are conducted using electron capture gas chromatographic methodology (Handbook of Analytical Methods for Environmental Samples - MOE, 1983). The analytical detection limit is 0.01 parts per million (ppm) on a dry weight basis.

RESULTS AND DISCUSSION

The results of the analyses are listed in Table 1. The highest soil PCB concentration detected was 400 ppm at sample site 30 located on the CPR right-of-way approximately 175 m E of CGE building No. 36. A replicate sample at the same site yielded a result of 280 ppm. Soil from the ditch adjacent to the CPR tracks (Site 24, 65 m WSW of building No. 36) had a PCB concentration of 210 ppm. A grassy area on the W side of Lansdowne Ave. on company property (Site 26, 30 m E of Bldg. No. 36) had 130 ppm PCBs in the surface soil. The highest off-CGE or railway property PCB level was 2.7 ppm at Site 20, a municipal property, 170 m SSE of CGE at the SE corner of Dupont St. and Lansdowne Ave. The highest PCB soil concentration detected on residential property was 0.51 ppm at Site 10, 340 m NE, of CGE. A similar concentration of 0.54 ppm PCB, was found in soil adjacent to the sidewalk (municipal property) on the N side of Davenport Rd. opposite Wiltshire Ave. (Site 4, 525 m NNW of CGE).

The MOE guideline for PCBs in soil is 50 ppm. The U.S. Environmental Protection Agency has the same PCB soil guideline. None of the municipal, commercial or residential properties sampled exceeded the 50 ppm guideline. One of the sites on CGE property and two of the samples collected along the CPR right-of-way exceeded the provincial criterion.

The data listed in Table 1 are illustrated in Figure 2. The sites where replicate soil samples were collected are represented by both analytical results separated by a slash. These data reveal that there is a clear gradient of PCB soil contamination relative to CGE building No. 36. PCB soil levels decreased rapidly with increasing distance. The highest PCB concentrations were found along the major traffic and railway rights-of-way, confirming the hypothesis of contamination through re-entrainment.

None of the control sites contained PCBs above the detection limit. Also, 5 sites within the survey area had no detectable (ND) PCB concentrations. These locations tended to be the more distant sites. Contrarily, none of the sample sites in close proximity to CGE were free of PCBs. In addition several of the soil sample locations on the edge of the

map in Figure 2 contained PCBs at levels about 10 times higher than the detection limit. Therefore, the extent of PCB soil contamination exceeds 500 m in all directions from CGE Bldg. No. 36, particularly N along Lansdowne Ave. and W along Davenport Rd. and Dupont St.

All the PCBs were identified as Aroclor 1260. The contamination found off-property was spectographically finger printed as the same PCB type detected from the CGE soil samples, therefore confirming CGE as the source. Also, the levels detected in the off-property soil samples were substantially lower than those found on CGE property, indicating that very little of the PCB known to have contaminated CGE property has migrated into the surrounding community.

AUGUST RESAMPLING

When the preliminary laboratory results were reviewed concerns were expressed regarding the unexpectedly high level of 400 ppm at sample site 30. This was the highest level encountered in the survey and it was not believed to be related to historical operations in the vicinity of CGE building Nos. 36 or 26. As soil PCB concentrations at this site were 8 times the 50 ppm criterion, the Phytotoxicology Section was requested to resample in the vicinity of Site 30 to define the local extent of contamination for possible soil removal action.

The precise location of each sample in the survey area could not be found (the sites were not staked) although field notes identified the 2 m collection area to within a few meters. On August 24, 1984 soil was resampled in the general area of Site 30, plus 10 m both E and W and three additional spots on the opposite side of the tracks. In total, 6 new sites were sampled, which completely bracketed the vicinity of the original site 30 (this explains the 6 dots in Figures 1 and 2 at this location). In addition each location was sampled in duplicate.

The results of these 12 samples are listed in Table 2, in addition to the levels originally detected during the May collection. The highest PCB concentration was 6.1 ppm and the lowest was 1.7 ppm. The 12 samples

averaged 2.9 ppm PCBs in surface soil. The mean of the 6 samples on the N side of the tracks was almost twice as high as the sample mean for the S side of the CPR tracks (3.8 vs 2.0). The excessive levels detected during the first (May) survey were not encountered in August. Because the May collection at this site was replicated and both samples returned high PCB concentrations the data was concluded to be accurate. Consultation with CGE and MOE Central Region lead to the supposition that the high levels could have resulted from a single leak in a stationary tank car creating a small isolated spill site. Regardless of its origin the August sampling confirmed that soil contamination along this section of the CPR road bed is not extensive.

IMPLICATIONS OF SOIL CONTAMINATION

The PCB concentrations detected in surface soil off-CGE or railway property do not exceed the 50 ppm guideline. The highest level (2.7 ppm) is 19 times lower than the guideline and the mean PCB concentration (0.42 ppm) from the municipal, residential and commerical properties is 119 times lower than the guideline.

PCBs are relatively immobile in the soil and contamination of the magnitude found in the vicinity of CGE will not result in the accumulation of detectable levels of PCBs in the edible portions of crops grown in urban vegetable gardens. Although the literature regarding plant uptake of PCB is limited it does suggest that PCB accumulation in plants generally is low. Factors affecting plant uptake from soil include PCB concentration, degree of chlorination, length of growth cycle, plant species and organic matter content of the soil. In experiments with carrots (known accumulators of lipophilic chemicals) no detectable PCB residues were detected after 120 days of growth in soil containing 0.05 ppm PCB. In another test using 100 ppm PCB (Aroclor 1254) accumulation was documented with 97% of the PCBs being found in the peel, suggesting that very little translocation occurred in the plant tissue (Strek and Weber, 1982).

CONCLUSIONS

1. *Surface soil (0-5 cm depth) in the residential community in the immediate vicinity of the CGE plant at 940 Lansdowne Ave. is contaminated with low levels of PCBs.*

2. *Contamination above current detection limits (0.01 ppm) was found to extend more than 500 m in all directions from CGE Building 36.*

3. *Analytical speciation of PCBs in soil samples from the residential area confirmed that the source of this contamination is the CGE property.*

4. *Off-CGE property contamination appears to have occurred through re-entrainment and subsequent migration of PCBs from spill sites on company property.*

5. *None of the residential, municipal or commercial properties sampled (excluding CGE or railway property) had PCB soil levels which exceeded the MOE 50 ppm guideline, with the highest level (2.7 ppm in a municipal location) and the survey area mean level (0.42 ppm) being lower than the guideline by factors of 19 and 119, respectively.*

6. *Based on information in available scientific literature the low level PCB contamination of soil detected off-CGE property should not inhibit plant growth or result in detectable root uptake by food crops grown in neighborhood vegetable gardens.*

DLMcL/hm

Attach.

PH/61/24

TABLE 1: PCB Concentration of Surface Soil (0-5 cm)

Sample Site (Map No.)	Distance and Direction from C.G.E. Bldg. 36	Property Tenure	Parts per Million† PCB (Aroclor 1260)
1	670 m NW	church	0.22
2	330 m NW	residential	0.30
3	430 m NW	residential	0.12
4	525 m NNW	municipal	0.54
5	535 m N	municipal	0.21
6	335 m SW	commercial	0.22
7	460 m SW	residential	0.08
8	340 m SW	residential	ND*
9	325 m SW	residential	ND
10	340 m NE	residential	0.51
11	490 m NE	municipal	0.18
12	430 m NNE	municipal	ND/ND**
13	160 m NE	C.G.E.	0.21
14	250 m NE	commercial	0.47
15	570 m S	residential	ND
16	415 m S	commercial	0.10
17	475 m SE	residential	0.10
18	275 m SE	residential	0.16
19	315 m S	residential	0.10
20	170 m SSE	municipal	1.3/2.7**
21	400 m N	C.G.E.	2.9
22	285 m N	C.G.E.	3.7
23	210 m NW	C.N.R.	0.27
24	65 m WSW	C.P.R.	210.0
25	50 m S	C.G.E.	0.36
26	30 m E	C.G.E.	130.0
27	150 m N	C.G.E.	13.0*
28	60 m NE	C.G.E.	32.0/23.0**
29	110 m S	C.G.E.	31.0
30	175 m E	C.P.R.	400./280.**
31	355 m E	C.P.R.	1.2
32	515 m ESE	municipal	0.10
33	280 m WSW	residential	0.07
34	485 m W	school	ND
35	200 m W	C.P.R.	0.52
36	control (urban) 2.2 km WSW residential		ND
37	control (urban) 3.8 km WNW commercial		ND
38	control (urban) 9.0 km WSW municipal		ND
39	control (rural) 18. km NW municipal		ND
40	control (rural) 36. km NW government		ND
Provincial Guideline: not to exceed			50.0

*ND - not detected, less than analytical detection limit of 0.01 ppm.

** - sample collected and analyzed in duplicate, both results reported.

† - parts per million dry ...

TABLE 2: PCB Concentration of Surface Soil (0–5 cm), Re-sample in the Vicinity of Site 30.

Sample Location Relative to Site 30			PPM* PCB
Site 30, Sampled May 17, 1984	rep	1	400
		2	280
Resample Site 30, August 24, 1984	rep	1	4.5
		2	4.0
10 m E	rep	1	3.5
		2	3.0
10 m W	rep	1	6.1
		2	1.7
Mean, N Side of CPR tracks			3.8
S Side of Tracks, Opposite Site 30 (August 24)	rep	1	2.1
		2	1.8
10 m E	rep	1	2.2
		2	2.1
10 m W	rep	1	1.8
		2	1.9
Mean, S side of CPR Tracks			2.0
Mean, May 17 Samples			340
Mean, August 24 Samples			2.9
MOE Guideline, Not to Exceed			50

* parts per million, Aroclor 1260, dry weight.

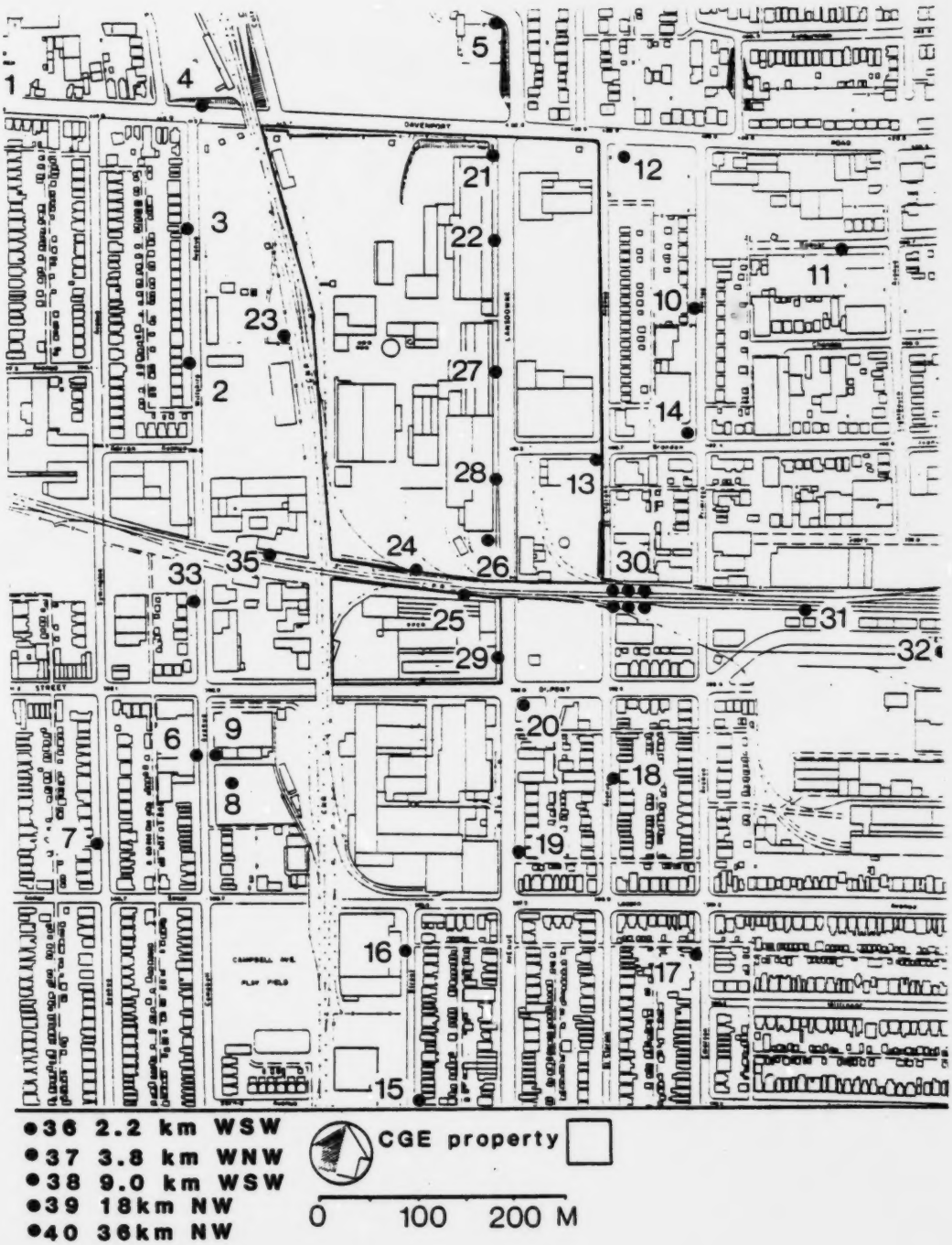

Figure 1: Location of PCB Soil Sample Sites.

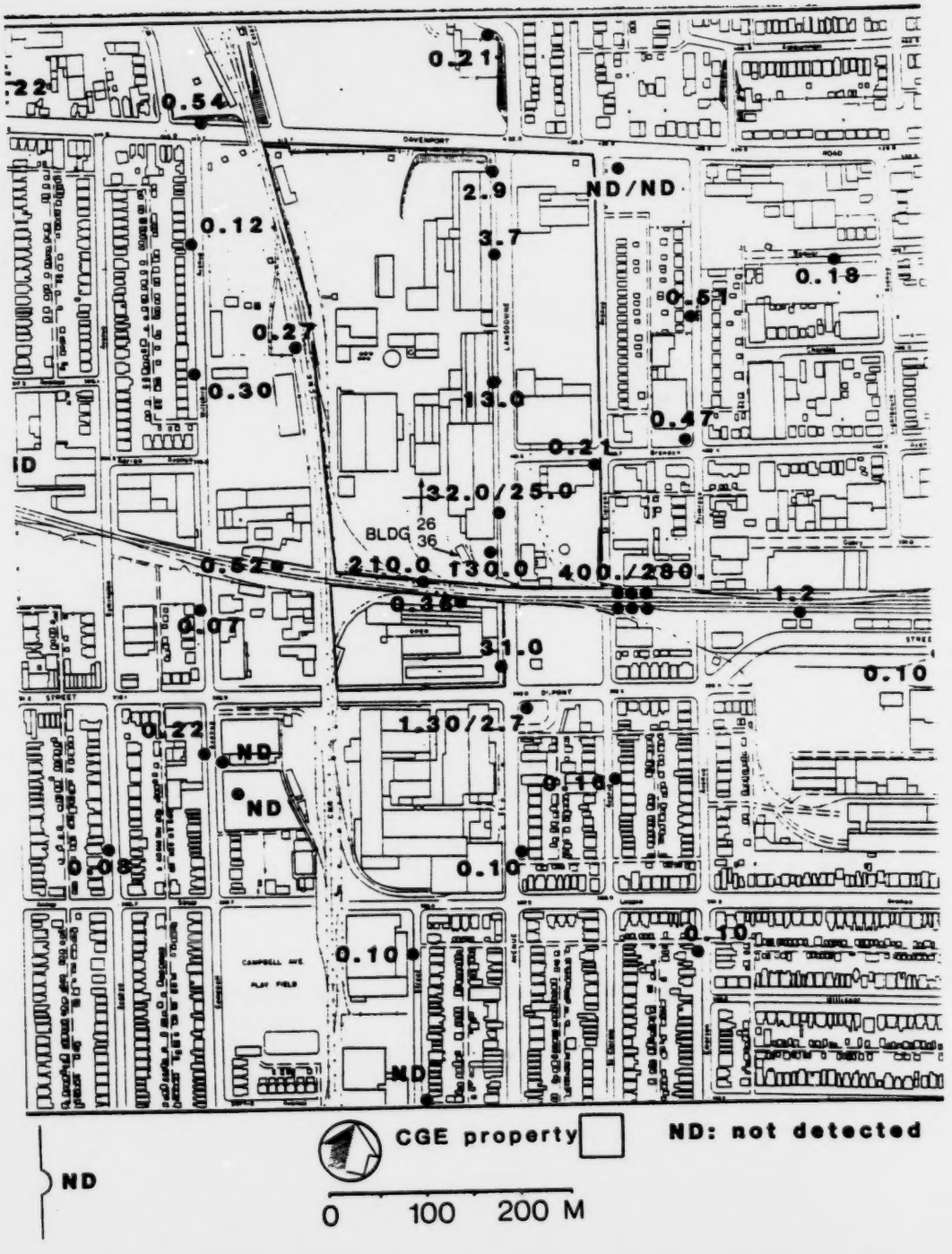

Figure 2: PCB Concentration (PPM) in Soil (0-5 cm)

APPENDIX 1

Description of Soil Sample Locations

Map No.		*Description*
1.	*church:*	*front lawn of Davenport-Perth United Church*
2.	*residential:*	*front lawn of 30 Wiltshire Ave.*
3.	*residential:*	*front lawn of 72 Wiltshire Ave.*
4.	*municipal:*	*1 m N of sidewalk, N side of Davenport Rd., opposite Wiltshire Ave.*
5.	*municipal:*	*between sidewalk and black iron fence at the bend in Lansdowne Rd., N of Davenport Rd.*
6.	*commercial:*	*60 m S of Dupont St., W side of Cambell Ave., opposite Duesbury-Jarrett Lithography.*
7.	*residential:*	*front lawn of 266 Symington Ave.*
8.	*residential:*	*back yard of 2 Antler St., Unit 40*
9.	*residential:*	*side garden adjacent to 2 Antler St., Unit 40.*
10.	*residential:*	*front lawn of 80 Primrose Ave.*
11.	*municipal:*	*S side of Beaver Ave., on grassy strip S of sidewalk, opposite 92 Beaver Ave.*
12.	*municipal:*	*NW corner of small municipal park, SE corner of St. Clarens Ave. and Davenport Rd.*
13.	*C.G.E.:*	*SW corner of Brandon Ave. and St. Clarens Ave.*
14.	*commercial:*	*NW corner of Primrose Ave. and Brandon Ave.*
15.	*residential:*	*front lawn of 17 Ward St.*
16.	*commercial:*	*SW corner of Ward St. and Lappin Ave., ¼ way between fire hydrant and entrance to American Standard.*
17.	*residential:*	*front lawn of 178 Emerson Ave.*
18.	*residential:*	*front lawn of 741 St. Clarens Ave.*
19.	*residential:*	*front lawn of 945 Lansdowne Ave.*

Map No.		Description
20.	municipal:	center of grassy area at TTC turnaround, SE corner of Dupont St. and Lansdowne Ave.
21.	C.G.E.:	10 m N of bus stop, SW corner of Lansdowne Ave. and Davenport Rd.
22.	C.G.E.:	30 m N of C.G.E. vehicle entrance on W side of Lansdowne Ave.
23.	C.N.R.:	W side of C.N.R. tracks, adjacent to fence by transformer station.
24.	C.P.R.:	N side of C.P.R. tracks, immediately W of fence/gate to C.G.E. crossing.
25.	C.G.E.:	S side of C.P.R. tracks, adjacent to C.G.E. bldg., by second hydro post W of Lansdowne Ave.
26.	C.G.E.:	grassy area at NW corner of Lansdowne Ave. and C.P.R. overpass, 30 m E of bldg. 36.
27.	C.G.E.:	adjacent to 4th tree S of C.G.E. vehicle entrance on W side of Lansdowne Ave.
28.	C.G.E.:	W side of Lansdowne Ave., 70 m N of C.P.R. tracks below two large outside bldg. vents.
29.	C.G.E.:	immediately N of entrance to C.G.E., NW corner of Lansdowne Ave. and Dupont St.
30.	C.P.R.:	N side of C.P.R. tracks, 75 m E of Lansdowne Ave.
31.	C.P.R.:	S side of C.P.R. tracks in grassy area at edge of embankment behind DX gas bar, on Dupont St.
32.	municipal:	S side of Dupont St., 20 m W of entrance to Gallaria Plaza.
33.	residential:	front lawn of 336 Cambell Ave.
34.	school:	2 m W of Long Jump pit in SE corner of school yard of Brother Edmund Rice Secondary School.
35.	C.P.R.:	N side of C.P.R. tracks, between main tracks and abandoned siding, immediately S of Union Felt Products and 70 m W of CPR/CNR intersection.
36.	residential:	front yard of 344 Annette St.

Map No.		Description
37.	commercial:	NE corner of St. Clair Ave. W and Scarlett Rd.
38.	municipal:	W of entrance to Etobicoke Public Library (Etonville Branch), SE corner of Burnhamthorpe Rd. and The East Mall.
39.	municipal:	20 m N of ticket booth, Claireville Conservation Area, NW of Indian Line and Steeles Ave.
40.	government:	outside field garden, Phytotoxicology Controlled Environment Laboratory (MOE) in Brampton.